TARGET VOLUME DELINEATION IN POST-OPERATIVE GLIOBLASTOMA. COMPARISON OF [18] FLOURODEOXYGLUCOSE-POSITRON EMISSION TOMOGRAPHY (FDG-PET) VERSUS MAGNETIC RESONANCE IMAGING (MRI)

Division of Radiation Oncology, Medanta-The Medicity, Gurgaon, India.

BACKGROUND

- MRI is the gold standard for defining target volumes in Glioblastoma (GBM) for adjuvant radiotherapy [1].
- FDG PET has been shown to differentiate necrotic tissues from viable tumor cells [2] and its uptake is correlated with tumor grading and prognosis.
- Delayed PET image acquisition leads to improved distinction between tumor and grey matter and has a potential for more accurate target delineation [3,4].
- FDG uptake in gliomas has a potential for dose escalation [4,5].

AIM

The aim of the study was:

- To delineate target volumes (GTV and CTV) based on MRI (T1 contrast) and PET based imaging for adjuvant RT of GBM.
- To evaluate the differences and the level of overlap (as Concordance Index, CI) between these target volumes.

MATERIALS AND METHODS

- Prospectively, 11 post-operative patients of GBM were enrolled in the study after informed consent.
- All patients underwent mould room procedure, CT Simulation, contrast enhanced MRI and delayed [18] FDG-PET as per the protocol.
- MRI and delayed [1 PET images were fused with planning CT scans and two sets of target volumes were contoured using respective images as GTV-MR: Contrast enhanced resection cavity + residual tumor on T1W post-operative MRI
  CTV-MR: GTV-MR + 2 cm margin all around except the anatomical barriers and critical structures
  GTV-PET: Metabolically active tumor volume on delayed (240-360 minutes after tracer injection) PET scan
  CTV-PET: GTV-PET + 2 cm margin
  GTV-X: Volume encompassing GTV-MR and GTV-PET
  CTV-X: Volume encompassing CTV-MR and CTV PET
  CI: Calculated as [(MRI Volume + PET Volume)/X] - 1 such that, full concordance yields a value of 1 & full non-concordance yields value of 0.
- Mean volumes were calculated for each category and volumetric analysis was done.
- All patients were actually treated as per the MR based target volumes.

RESULTS

- Mean volumes (in cc) and CI for GTV
  - GTV-MR: 54.99
  - GTV-PET: 17.95
  - GTV-X: 63.93
  - CI = 0.16

- Mean volumes (in cc) and CI for CTV
  - CTV-MR: 262.29
  - CTV-PET: 211.9
  - CTV-X: 346.28
  - CI = 0.46

- Delta MRI-PET of 32.6 percent of GTV-MR volume and mean GTV-X was only 16.3 percent more than GTV-MR volume.
- Similarly, mean CTV-PET was 80.7 percent of CTV-MR volume and mean CTV-X was 32 percent more than CTV-MR volume.

CONCLUSION

- There was an adequate level of agreement between the volumes delineated by using PET and MRI based fusions for contouring.
- It can be hypothesized that inclusion of PET based abnormality while delineating the target volumes for GBM will lead only to moderate increase in the treated volumes of brain.
- Treating this combined volume (X here) might prove beneficial in terms of reduced marginal recurrences.
- The study of recurrence pattern in these patients in future trials may prove or refute its actual clinical significance.

BIBLIOGRAPHY